

PRELIMINARY DATA SUMMARY

September 1992

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

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CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

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PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD) of the year 1929. In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Clifford F. Baron at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

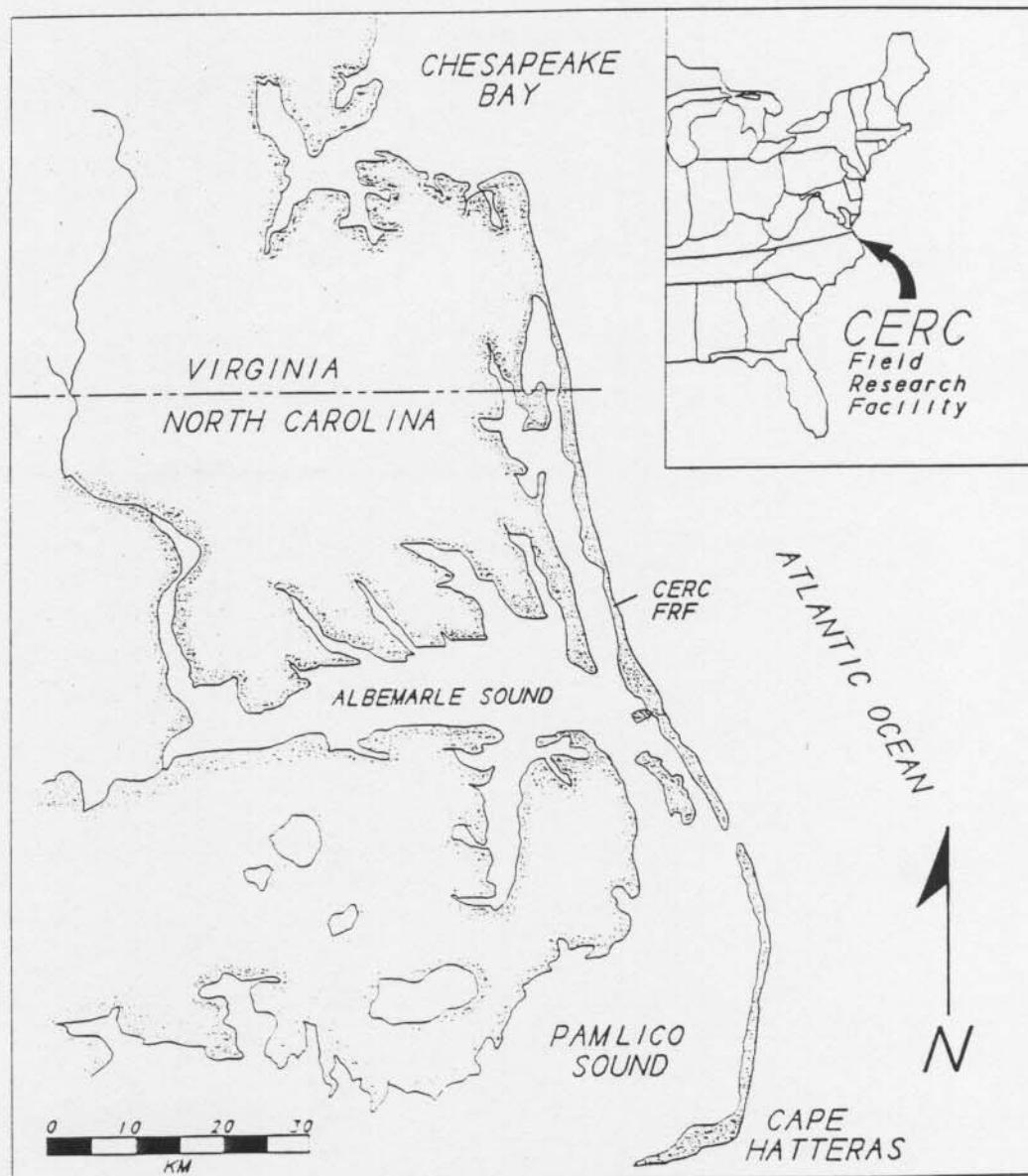


Figure 1. FRF Location Map

Table 1: Instrument Status/Data Availability

SEPTEMBER 1992

Gage ID	Description/Remarks	Depth at Sensor		Day of the month																																	
				1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0				
616	Barometric Pressure		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*			
604	Precipitation		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
624	Air Temperature		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*		
932	Anemometer at seaward end of pier Elevation 19 m (NGVD)		Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*		
625	Baylor staff at station 18+60 on FRF pier	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*		
111	Pressure gage 309 m north of FRF pier (0.9 km offshore)	Approx. 7.8 m NGVD	Gage Status	-	-	-	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
			Data Collected	-	-	-	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*		
630	Waverider buoy 4.0 km offshore	Approx. 17 m NGVD	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	-	-	*	*	*	*	*	*	*	*	*	*		
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	-	-	/	*	*	*	*	*	*	*	*		
519	Current meter 320 m north of FRF pier (0.9 km offshore)	see Figure 7	Gage Status	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	
865-1370	NOAA tide station at seaward end of FRF pier		Gage Status	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
			Data Collected	*	*	*	/	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	/	*	*	/	*	*	*	*	*	*	*	*	*	
	Supplemental Observations (daily oceanographic and meteorological observations)		Daily observation	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Gage Status

Operational = *

Partial = /

Non-Operational = -

Daily Observation

Complete = *

Partial = /

None = -

Data Collected

All = *

Partial = /

None = -

True North

Pier Building at 0+40 to 1+00

12 Inch Rain Gage at 0+30

Instrument Shelter at 0+40

Current Meter
320 m north of pier

Pressure Gage
309 m north of pier

Instrument
Shelter

Rain Gage
Ramp

Pier
Building

Access Road

Pier

Baylor
at 18+60

Off shore
Waverider Buoy

CURRI TUCK SOUND

ATLANTIC OCEAN

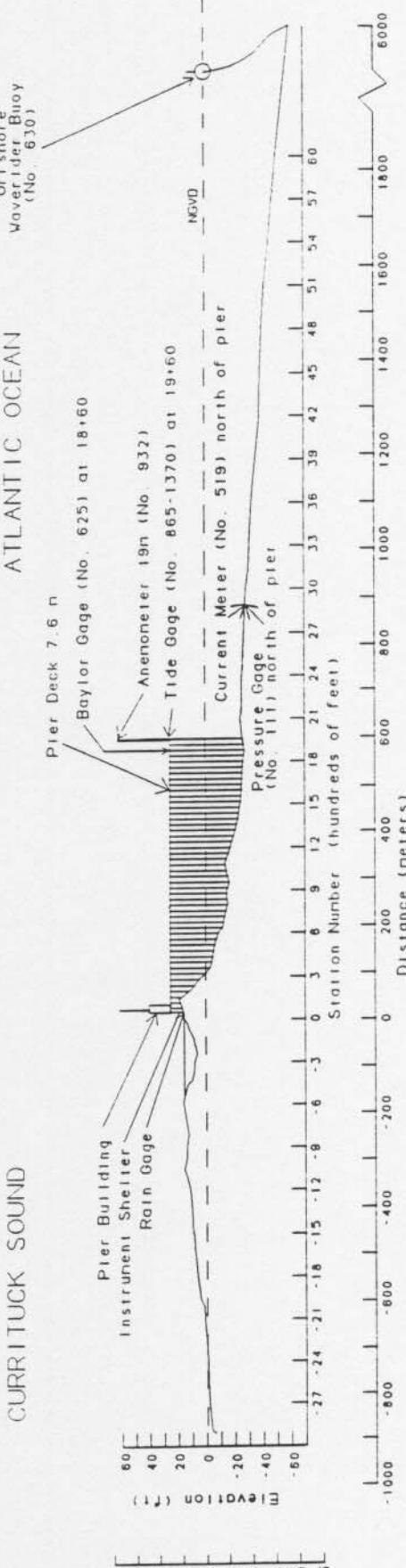


Figure 2. Instrument locations at FRF (all elevations from NGVD, all distances from FRF baseline).

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored using a Digital Equipment Corporation VAX 11/750. For each instrument a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a WeatherMeasure Skyyane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Wind directions indicate where the wind is coming from. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $mm \times .03937 = \text{in.}$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $mb \times 0.02953 = \text{in. Hg}$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $m/s \times 1.943 = kn$

Table 2: Meteorological Data

Sep 1992

Day	Hour	Wind Speed m/sec	Wind	Temperature	Atm	Precipitation
			Direction deg TN	deg C	mb	mm
1	100	3	255	24.1	1016.0	0
	700	6	39	23.5	1017.9	0
	1300	6	21	25.3	1019.1	0
	1900	6	71	22.5	1019.2	0
2	100	5	105	22.1	1020.7	0
	700	6	127	23.7	1021.6	0
	1300	6	135	28.3	1021.6	0
	1900	7	158	23.5	1020.2	0
3	100	5	167	22.8	1020.5	0
	700	5	165	25.3	1020.5	0
	1300	8	143	26.7	1019.2	0
	1900	6	185	25.6	1018.3	0
4	100	4	214	24.1	1018.9	0
	700	4	226	25.2	1019.8	0
	1300	6	111	28.1	1019.8	0
	1900	3	258	23.9	1020.2	15
5	100	2	351	23.1	1021.2	0
	700	0		24.1	1021.9	0
	1300	3	128	27.6	1021.7	0
	1900	3	106	24.9	1021.7	0
6	100	3	112	24.8	1021.5	0
	700	3	112	24.6	1021.6	0
	1300	5	21	23.8	1021.2	0
	1900	3	22	23.9	1021.2	0
7	100	1	5	23.0	1020.4	0
	700	4	2	23.6	1020.8	0
	1300	3	68	26.8	1020.2	0
	1900	2	103	24.0	1019.0	0
8	100	1	101	23.1	1018.8	0
	700	2	359	23.8	1019.0	0
	1300	3	115	27.5	1018.1	0
	1900	3	177	24.4	1017.0	0
9	100	2	166	23.7	1017.6	0
	700	1	242	25.9	1018.3	0
	1300	4	109	28.1	1017.9	0
	1900	5	149	24.9	1017.1	0
10	100	7	142	24.4	1016.6	0
	700	1	49	25.4	1017.1	0
	1300	2	166	26.2	1016.1	0
	1900	5	162	24.2	1014.0	5
11	100	2	193	23.6	1013.8	0
	700	5	351	23.7	1013.6	0
	1300	9	359	24.1	1015.7	0
	1900	10	355	22.9	1017.1	0
12	100	9	16	22.1	1018.9	0
	700	9	12	21.5	1021.7	0
	1300	9	357	21.6	1022.7	0
	1900	8	8	20.1	1022.2	0
13	100	8	47	21.3	1022.1	0
	700	10	39	21.3	1022.9	0
	1300	8	18	22.2	1023.0	0
	1900	7	33	20.2	1022.4	0
14	100	6	52	20.0	1022.2	0
	700	7	30	20.8	1022.2	0
	1300	8	43	22.3	1022.2	0
	1900	8	36	21.2	1022.1	0
15	100	8	30	21.3	1021.5	0
	700	10	16	22.6	1022.4	0
	1300	8	19	24.0	1022.6	0
	1900	7	16	22.2	1021.7	0
16	100	6	20	21.9	1021.8	0
	700	6	35	22.4	1021.9	0
	1300	2	23	25.6	1021.3	0
	1900	3	96	22.6	1019.4	0

* electronic problems

(Continued)

(Sheet 1 of 2)

Table 2: Meteorological Data

Sep 1992

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
17	100	1	176	21.8	1019.2	0
	700	1	243	23.3	1019.5	0
	1300	6	134	27.4	1018.5	0
	1900	6	185	24.8	1016.6	0
18	100	4	216	23.7	1017.2	0
	700	3	216	24.4	1016.6	0
	1300	7	184	29.1	1014.9	0
	1900	7	188	24.8	1013.2	0
19	100	6	194	24.6	1011.5	0
	700					0
	1300					0
	1900			Hardware Error		0
20	100					0
	700					44
	1300	9	67	23.1	1014.8	5
	1900	8	65	22.9	1014.9	0
21	100	5	86	23.5	1014.4	0
	700	3	85	24.4	1014.7	0
	1300	4	91	27.0	1013.9	0
	1900	4	109	24.4	1013.2	0
22	100	2	156	23.8	1012.0	0
	700	3	157	25.0	1011.4	0
	1300	6	140	27.8	1009.8	0
	1900	6	174	25.1	1008.1	0
23	100	2	205	24.5	1008.4	0
	700	14	8	22.6	1011.3	0
	1300	15	10	18.8	1014.4	0
	1900	16	15	18.9	1016.0	0
24	100	14	20	19.1	1016.8	0
	700	16	22	18.9	1018.3	0
	1300	17	11	17.4	1019.2	0
	1900	18	23	18.4	1018.2	0
25	100	19	30	20.4	1014.5	3
	700	20	24	21.6	1011.0	12
	1300	8	263	21.3	1014.0	0
	1900	5	276	16.7	1017.5	0
26	100	3	297	16.5	1019.5	0
	700	2	300	15.8	1020.3	0
	1300	2	102	19.8	1019.2	0
	1900	4	117	20.9	1018.4	0
27	100	2	106	21.8	1017.5	0
	700	3	160	23.1	1017.1	0
	1300	4	126	27.1	1016.0	0
	1900	6	156	23.0	1015.6	0
28	100	0		21.2	1015.4	0
	700	4	28	22.8	1015.5	0
	1300	4	58	22.0	1014.2	0
	1900	8	59	22.3	1012.4	13
29	100	4	353	21.9	1011.4	0
	700	13	358	20.2	1013.6	3
	1300	12	348	19.7	1015.4	0
	1900	12	8	17.6	1017.5	0
30	100	11	24	16.6	1017.4	0
	700	10	23	15.1	1018.0	0
	1300	11	357	15.2	1017.8	0
	1900	11	1	14.7	1018.0	0
			Resultant 3	Mean 41	Mean 22.9	Total 100

* electronic problems

(Sheet 2 of 2)

PART III: WAVE DATA

Wave data are collected from a Baylor staff gages (Gage 625), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on optical disc using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 3 hr. The sampling rate is two times per second for five contiguous 34-min records. This report reflects the data collection periods of 0100, 0700, 1300, and 1900 EST. The results are based only on the first 34 minute record.

Wave height H_{mo} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to optical disc.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{mo} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, the presence of multiple wave trains containing nearly equal energy, and statistical variations in spectral estimations.

Table 3: Wave Data

Sep 1992

Day	Hour	625		111		630	
		Baylor at 18+60 Hmo,m	Tp.sec	Pressure Gage Hmo,m	Tp.sec	Offshr Wvrdr Hmo,m	Tp.sec
1	0100	0.36	8.00	0.42	9.14	0.40	6.74
	0700	0.34	8.53	0.36	8.26	0.43	8.26
	1300	0.74	4.49	0.70	4.41	0.90	4.74
	1900	0.59	4.41	0.54	4.27	0.70	4.27
2	0100	0.52	4.06	0.51	4.13	0.60	8.53
	0700	0.54	3.46	0.48	8.00	0.63	8.00
	1300	0.53	3.77	0.50	3.66	0.58	8.26
	1900	0.52	7.76	0.51	7.53	0.66	8.00
3	0100	0.49	4.06	0.53	3.88	0.61	4.06
	0700	0.50	4.41	0.54	4.50	0.66	4.06
	1300	0.54	4.27	0.57	4.50	0.69	4.41
	1900	0.46	7.76	0.54	7.76	0.62	4.49
4	0100	0.44	4.74	0.51	4.66	0.55	4.83
	0700	0.34	4.74	0.37	12.19	0.48	4.66
	1300	0.37	4.49	0.40	12.80	0.44	4.41
	1900	0.30	7.11	0.32	7.76	0.40	8.26
5	0100	0.33	8.00	0.33	8.00	0.43	7.76
	0700	0.31	7.31	0.31	11.64	0.40	7.31
	1300	0.31	11.64	0.32	11.13	0.37	11.64
	1900	0.31	10.67	0.34	6.56	0.38	12.19
6	0100	0.42	3.37	0.40	10.67	0.46	6.74
	0700	1.02	7.31	1.01	6.56	1.28	6.92
	1300	1.09	7.11	1.07	7.11	1.12	7.31
	1900	0.87	6.74	0.86	6.74	1.08	6.74
7	0100	0.77	7.11	0.79	6.74	0.93	6.40
	0700	0.73	8.00	0.74	8.53	0.84	8.53
	1300	0.89	9.48	0.92	8.83	1.05	9.48
	1900	0.89	11.13	0.86	10.67	0.99	9.85
8	0100	0.84	10.67	0.89	10.24	0.88	10.67
	0700	0.74	10.24	0.82	10.24	0.90	10.24
	1300	0.77	10.24	0.71	9.48	0.92	9.85
	1900	0.69	10.67	0.67	9.48	0.82	9.85
9	0100	0.75	9.14	0.73	9.48	0.85	9.85
	0700	0.71	9.48	0.80	9.85	0.83	9.85
	1300	0.68	8.53	0.73	8.53	0.97	8.83
	1900	0.63	10.24	0.58	9.48	0.76	9.14
10	0100	0.68	9.48	0.67	9.48	0.82	9.48
	0700	0.60	9.85	0.61	9.48	0.73	10.24
	1300	0.68	5.57	0.72	8.83	0.81	5.95
	1900	0.68	7.53	0.73	9.48	0.87	9.48
11	0100	0.73	9.48	0.75	7.31	0.99	7.31
	0700	0.76	7.53	0.75	7.31	0.97	7.31
	1300	1.04	4.20	1.05	4.74	1.38	4.83
	1900	1.06	5.33	1.12	5.33	1.33	5.22
12	0100	1.20	5.45	1.23	5.57	1.36	5.45
	0700	1.19	6.09	1.16	5.95	1.31	5.95
	1300	1.12	6.40	1.15	5.95	1.32	6.24
	1900	1.07	6.09	1.01	5.82	1.14	6.09
13	0100	1.03	6.92	0.97	6.56	1.29	6.92
	0700	1.35	5.33	1.30	4.57	1.50	5.82
	1300	1.16	5.45	1.14	5.82	1.34	5.33
	1900	1.03	8.00	0.96	8.83	1.21	6.56
14	0100	0.90	9.85	0.89	7.53	1.10	8.00
	0700	0.96	8.83	0.93	9.85	1.13	6.74
	1300	1.09	4.57	0.97	9.14	1.20	5.33
	1900	1.13	6.09	1.12	8.83	1.28	5.33
15	0100	1.17	5.33	1.12	5.57	1.32	5.33
	0700	1.16	5.22	1.13	5.95	1.34	8.26
	1300	1.21	8.26	1.20	8.83	1.42	7.76
	1900	1.11	8.00	1.10	9.14	1.38	7.53
16	0100	0.93	9.14	0.92	9.14	1.09	8.26
	0700	0.90	8.53	0.87	8.26	0.99	8.83
	1300	0.67	8.00	0.68	8.00	0.78	8.83
	1900	0.65	7.76	0.65	7.76	0.75	7.53

* Electronic problems

(Continued)

(Sheet 1 of 2)

Table 3: Wave Data

Sep 1992

Day	Hour	625		111		630	
		Baylor	at 18+60	Pressure Gage		Offshr	Wvrdr
17	0100	0.59	8.83	0.54	8.26	0.68	7.76
	0700	0.52	8.83	0.56	8.83	0.65	8.53
	1300	0.50	8.53	0.54	8.83	0.63	8.83
	1900	0.52	8.53	0.52	8.00	0.64	8.53
18	0100	0.55	9.48	0.55	9.85	0.70	9.85
	0700	0.52	9.14	0.57	9.14	0.68	8.83
	1300	0.52	8.83	0.50	8.83	0.68	7.53
	1900	0.46	8.83	0.44	8.53	0.62	8.83
19	0100	0.43	8.26	0.38	9.48	0.60	7.76
	0700						
	1300			Hardware Error			
	1900						
20	0100						
	0700	0.91	4.92	0.76	4.83		
	1300	1.03	5.33	0.88	5.22	Gage	
	1900	1.19	5.69	1.10	5.57		
21	0100	0.95	5.45	0.87	5.45	Inoperative	
	0700	0.72	4.92	0.71	5.12		
	1300	0.71	5.22	0.68	5.22		
	1900	0.68	5.45	0.63	5.57		
22	0100	0.68	5.57	0.66	5.22		
	0700	0.68	5.57	0.69	5.82	0.95	6.09
	1300	0.74	5.82	0.79	5.57	0.95	6.24
	1900	0.64	8.83	0.75	9.14	0.88	7.76
23	0100	0.74	8.00	0.81	8.53	0.95	8.53
	0700	1.46	5.12	1.68	5.12	1.76	4.92
	1300	2.23	7.11	2.52	7.31	2.69	7.31
	1900	2.42	8.00	2.57	7.53	3.03	8.00
24	0100	2.29	7.76	2.51	7.76	2.77	7.76
	0700	2.70	8.00	3.01	8.00	3.23	8.83
	1300	2.66	8.53	3.58	10.24	3.63	8.53
	1900	3.04	10.67	3.71	10.67	4.17	11.13
25	0100	2.72	10.67	3.72	10.24	3.98	9.14
	0700	3.18	11.13	3.96	9.48	4.22	8.83
	1300	2.09	10.24	2.52	11.13	2.54	11.13
	1900	1.29	10.67	1.43	10.67	1.71	10.67
26	0100	1.21	9.85	1.38	10.67	1.56	10.67
	0700	1.11	10.24	1.30	9.48	1.32	9.85
	1300	0.96	9.14	1.11	10.67	1.52	9.48
	1900	0.99	9.14	1.10	10.24	1.29	9.85
27	0100	0.82	10.67	0.99	10.67	1.07	8.00
	0700	0.80	10.24	0.98	11.64	1.13	10.67
	1300	0.71	8.83	0.88	10.67	0.98	10.24
	1900	0.77	10.67	0.95	9.85	1.04	9.85
28	0100	0.79	10.24	0.95	10.24	1.03	10.67
	0700	0.91	9.85	1.19	9.14	1.17	10.24
	1300	0.83	9.85	1.02	9.48	1.16	9.14
	1900	0.97	9.14	1.03	8.53	1.26	8.83
29	0100	0.97	10.24	1.03	10.67	1.11	10.24
	0700	1.58	5.57	1.65	5.69	2.05	5.69
	1300	1.52	6.40	1.63	6.56	1.86	6.09
	1900	1.51	6.40	1.64	6.56	1.80	6.40
30	0100	1.57	6.24	1.76	6.24	1.95	5.69
	0700	1.65	5.95	1.83	6.56	1.97	6.74
	1300	1.47	7.11	1.63	7.11	1.77	6.74
	1900	1.27	12.19	1.35	6.40	1.49	6.40
	Mean	0.96	7.65	1.09	8.23	1.20	7.81
	Std dev	0.57	2.16	0.73	1.97	0.77	1.93

* Electronic problems

(Sheet 2 of 2)

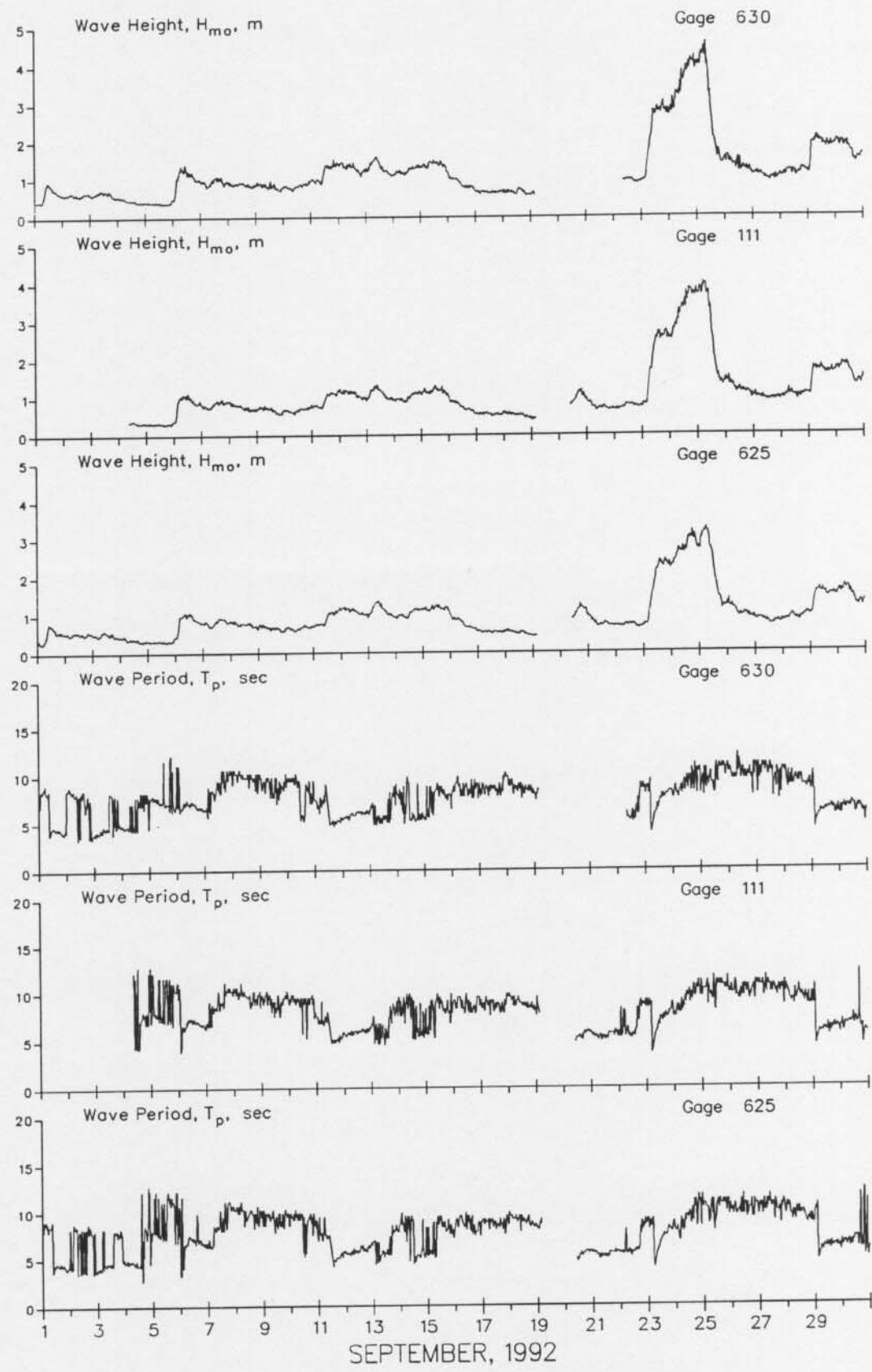


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the cross-shore and longshore data. Current directions indicate the direction that the current is moving towards.

IMPORTANT NOTE

Direction resultants regarding the current meter data (gages 519 and 529) may be in error by minus 5 degrees due to a faulty compass reading. Please call us if you must use this data.

Table 4: Current Data
Sep 1992

Alongshore Cross-shore Resultant Time Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	Speed	Dir
1 0100-Along Cross Result										13	S
1 0700-Along Cross Result	10 12 15	S on 211			14 3 14	N on 326				6	off
1 1300-Along Cross Result										14	135
1 1900-Along Cross Result										8	S
2 0100-Along Cross Result										3	off
2 0700-Along Cross Result	29 7 30	N on 326			30 23 38	N on 303				8	137
2 1300-Along Cross Result										7	S
2 1900-Along Cross Result										15	off
3 0100-Along Cross Result										16	95
3 0700-Along Cross Result	36 0 36	N on 340			76 19 79	N on 326				4	N
3 1300-Along Cross Result										1	on
3 1900-Along Cross Result										4	326
4 0100-Along Cross Result										18	S
4 0700-Along Cross Result	10 12 15	N off 31			34 14 36	N off 2				8	off
4 1300-Along Cross Result										20	135
4 1900-Along Cross Result										7	S
5 0100-Along Cross Result										7	off
5 0700-Along Cross Result	61 0 61	N on 340			21 0 21	N on 340				1	155
5 1300-Along Cross Result										1	130
5 1900-Along Cross Result										2	N

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1992

Day	Alongshore Cross-shore Resultant Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter	
		Dye at (579 m) (surface)	Distance from Baseline	Dye at Mid-Surf Zone (surface)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir
6 0100-Along Cross Result									28	S
6 0700-Along Cross Result	44 S			51 S				25 S	7	off
6 1300-Along Cross Result	0 on 44 160	165		46 on 68 202			North		29	145
6 1900-Along Cross Result									32	S
7 0100-Along Cross Result									13	off
7 0700-Along Cross Result	61 S 15 on 63 174			20 S 0			North	13 S	35	137
7 1300-Along Cross Result				20 160					18	S
7 1900-Along Cross Result									2	off
8 0100-Along Cross Result									18	155
8 0700-Along Cross Result	47 S 5 on 47 166			13 N 51 off 52 56			South	5 N	7	off
8 1300-Along Cross Result									21	146
8 1900-Along Cross Result									17	S
9 0100-Along Cross Result									4	off
9 0700-Along Cross Result	14 S 0 on 14 160			61 N 15 on 63 326			South	22 S	18	146
9 1300-Along Cross Result									13	S
9 1900-Along Cross Result									3	off
10 0100-Along Cross Result									17	160
10 0700-Along Cross Result	11 S 4 on 12 182			30 N 9 on 32 323			South	30 N	6	off
10 1300-Along Cross Result									19	144
10 1900-Along Cross Result									12	S
									1	on
									4	168
									2	S
									1	off
									2	160
									3	N
									15	off
									15	58
									10	N
									3	on
									10	324

KEY = All speeds in cm/sec

N = Northward, Shore parallel

S = Southward, Shore parallel

on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1992

Day	Pier Measurements						Beach Measurements			Current Meter	
	Alongshore Cross-shore Resultant		Dye at Mid-Surf Zone (surface)		(500m Updrift)			Offshore Depth -5.6m (NGVD)		0.9 km ID #519	
Time	Dye at (579 m) (surface)	Distance from Baseline (m)	Speed	Dir	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	
11 0100-Along Cross Result									13	N	
11 0700-Along Cross Result	29 7 30	S on 174	152		68 34 76	N on 313		21 N South	4 13	off 358	
11 1300-Along Cross Result									2 3	N off 39	
11 1900-Along Cross Result									28 9 29	S off 143	
12 0100-Along Cross Result									30 15 34	S off 133	
12 0700-Along Cross Result	47 19 51	S on 182	152		76 57 95	S on 197		51 S North	33 11 35	S off 142	
12 1300-Along Cross Result									36 37	S 143	
12 1900-Along Cross Result									33 13 36	S off 139	
13 0100-Along Cross Result									26 9 27	S off 140	
13 0700-Along Cross Result	38 10 39	S on 174	152		87 22 90	S on 174		22 S North	28 12 30	S off 137	
13 1300-Along Cross Result									27 10 26	S off 138	
13 1900-Along Cross Result									23 7 24	S off 144	
14 0100-Along Cross Result									21 7 22	S off 142	
14 0700-Along Cross Result	23 12 26	S on 187	152		23 18 29	N on 303		0 South	16 7 17	S off 137	
14 1300-Along Cross Result									22 10 24	S off 135	
14 1900-Along Cross Result									19 8 20	S off 137	
15 0100-Along Cross Result									23 10 25	S off 138	
15 0700-Along Cross Result	44 13 45	S on 177	152		34 25 42	S on 197		26 S North	16 10 19	S off 128	
15 1300-Along Cross Result									32 10 33	S off 143	
15 1900-Along Cross Result									17 4 17	S off 147	

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
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 on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1992

Alongshore Cross-shore Resultant Time Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter	
	Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		Dye 12m offshore (surface)		Location		Speed	Dir	
	Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed	Dir	
16 0100-Along Cross Result				0			15	S	19	S	
16 0700-Along Cross Result	44	S	152	8	on	North	18	S	8	off	
16 1300-Along Cross Result	0			8	250		19		21	138	
16 1900-Along Cross Result	44	160							19		
17 0100-Along Cross Result							19	S	4	off	
17 0700-Along Cross Result	5	N		47	N	South	25	N	19	148	
17 1300-Along Cross Result	0	off	152	35	on		14		14		
17 1900-Along Cross Result	5	346		59	303		15	S	2	on	
18 0100-Along Cross Result							14		14	167	
18 0700-Along Cross Result	41	N		87	N	South	38	N	5	S	
18 1300-Along Cross Result	12	off	152	0			15		3	off	
18 1900-Along Cross Result	42	357		87	340		15	S	6	128	
19 0100-Along Cross Result							15		6		
19 0700-Along Cross Result	24	N		87	N	South	12	N	4	N	
19 1300-Along Cross Result	12	off	152	0			15		3	on	
19 1900-Along Cross Result	27	7		87	340		15	S	5	305	
20 0100-Along Cross Result							15		7		
20 0700-Along Cross Result	4	N		32	S	North	83	S	11	N	
20 1300-Along Cross Result	5	on	152	40	on		15		11	315	
20 1900-Along Cross Result	6	286		51	211		15	S	16		

KEY = All speeds in cm/sec

N = Northward, Shore parallel

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on = onshore off = offshore

Table 4: Current Data (Continued)
Sep 1992

Alongshore Cross-shore Resultant Time Day	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Dye at Mid-Surf Zone (surface)	Location	Dye 12m offshore (surface)	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	
21 0100-Along Cross Result								15	S
								12	off
								19	121
21 0700-Along Cross Result	38 4 38	S on 166	177	38 10 39	S off 146	North	4 S	21 23 31	S off 113
21 1300-Along Cross Result								6	S
								1	
								6	160
21 1900-Along Cross Result								18 4 19	S off 147
22 0100-Along Cross Result								9 0 9	S off 160
22 0700-Along Cross Result	23 6 24	N on 326	177	87 22 90	N on 326	North	50 N	13 3 13	S off 147
22 1300-Along Cross Result								2	N
								2	off
								3	31
22 1900-Along Cross Result								2 2 3	N on 302
23 0100-Along Cross Result								11 6 12	N on 310
23 0700-Along Cross Result	87 0 87	S 177 160	177	152 0 152	S 160	North	43 S	29 10 31	S off 142
23 1300-Along Cross Result								49 15 51	S off 143
23 1900-Along Cross Result								63 23 67	S off 140
24 0100-Along Cross Result								52 18 55	S off 141
24 0700-Along Cross Result	55 28 62	S on 187	323	152 38 157	S on 174	North	28 S	66 24 70	S off 140
24 1300-Along Cross Result								82 30 88	S off 140
24 1900-Along Cross Result								95 35 101	S off 140
25 0100-Along Cross Result								88 38 95	S off 137
25 0700-Along Cross Result	102 0 102	S 213 160	213	76 23 80	S on 177	North	22 S	93 35 99	S off 139
25 1300-Along Cross Result								58 16 60	S off 145
25 1900-Along Cross Result								12 1 12	S off 154

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

Table 4: Current Data (Concluded)
Sep 1992

Alongshore Cross-shore Resultant ---- Time Day	Pier Measurements						Beach Measurements (500m Updrift)			Current Meter	
	Dye at (579 m) (surface)	Distance from Baseline (m)	Dye at Mid-Surf Zone (surface)	Speed	Dir	Dye 12m offshore (surface)	Location	Speed	Dir	0.9 km Offshore Depth -5.6m (NGVD) ID #519	
26 0100-Along Cross Result										23	S
26 0700-Along Cross Result	20 8 22	S off 138	152	20 5 20	S off 146		South	9	S	17 2 17	S off 164
26 1300-Along Cross Result										13 5 14	S off 137
26 1900-Along Cross Result										0 2 2	on 250
27 0100-Along Cross Result										3 5 6	N on 280
27 0700-Along Cross Result	30 5 31	N on 331	152	41 4 41	N off 346		South	8	N	13 9 16	N on 306
27 1300-Along Cross Result										17 3 17	N on 330
27 1900-Along Cross Result										14 7 16	N on 314
28 0100-Along Cross Result										11 6 13	N on 310
28 0700-Along Cross Result	25 3 26	N on 334	140	38 4 38	N on 334		South	54	N	17 5 18	N on 323
28 1300-Along Cross Result										7 1 7	N 340
28 1900-Along Cross Result										20 2 20	N on 333
29 0100-Along Cross Result										4 1 4	S off 149
29 0700-Along Cross Result	87 0 87	S 0 160	152	87 0 87	S 0 160		North	51	S	44 11 46	S off 146
29 1300-Along Cross Result										52 15 54	S off 144
29 1900-Along Cross Result										44 12 46	S off 145
30 0100-Along Cross Result										50 16 52	S off 142
30 0700-Along Cross Result	47 7 47	S on 169	140	87 26 91	S on 177		North	61	S	44 10 45	S off 147
30 1300-Along Cross Result										55 12 56	S off 148
30 1900-Along Cross Result										42 9 43	S off 148

KEY = All speeds in cm/sec

N = Northward, Shore parallel

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PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is oriented 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A Bucket Thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The temperature is then read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the depth of visibility.

Table 5: Supplemental Observations

Sep 1992

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone,m	Water Characteristics at Pier End		
		Primary	Secondary			Temp.,C	Density g/cc	Secchi Vis.,m
1	0800	25		100	5	22.6	1.0224	4.3
2	0800	115	150	110	46	23.2	1.0222	4.6
3	0715	115			38	23.6	1.0222	4.3
4	0800	90			43	18.9	1.0234	2.1
5	0900	85			24	23.2	1.0218	4.9
6	0910	45			114	25.3	1.0175	3.4
7	0835	35			63	24.7	1.0188	3.0
8	0715	105			37	24.7	1.0196	2.1
9	0745	110	135		32	25.1	1.0192	3.0
10	0730	105			35	24.2	1.0218	4.0
11	0745	75	25	85	51	22.9	1.0223	4.6
12	0840	25		25	79	23.7	1.0220	2.1
13	0830	20		45	131	23.0	1.0207	2.1
14	0735	40	75	90	59	22.8	1.0196	1.5
15	0750	25		75	81	23.0	1.0189	1.8
16	0800	75	35	95	49	23.3	1.0201	1.2
17	0750	60			31	23.9	1.0206	0.6
18	0750	80			37	23.8	1.0211	1.8
19	0900	110			35	24.0	1.0222	2.1
20	0930	45		35	49	24.0	1.0220	3.0
21	0800	110	60	45	70	23.8	1.0208	2.1
22	0830	95			47	24.0	1.0206	3.7
23	0815	10		25	378	23.3	1.0220	2.1
24	0815	60		55	492	21.5	1.0216	0.6
25	0830	60		55	543	22.1	1.0182	0.3
26	0630	60			98	22.0	1.0210	0.3
27	0945	75			90	23.5	1.0210	0.6
28	0805	95		inoperative	122	22.7	1.0215	0.6
29	0815	20		35	114	22.0	1.0217	0.9
30	0802	50		55	271	20.4	1.0202	0.6

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Sep 1992

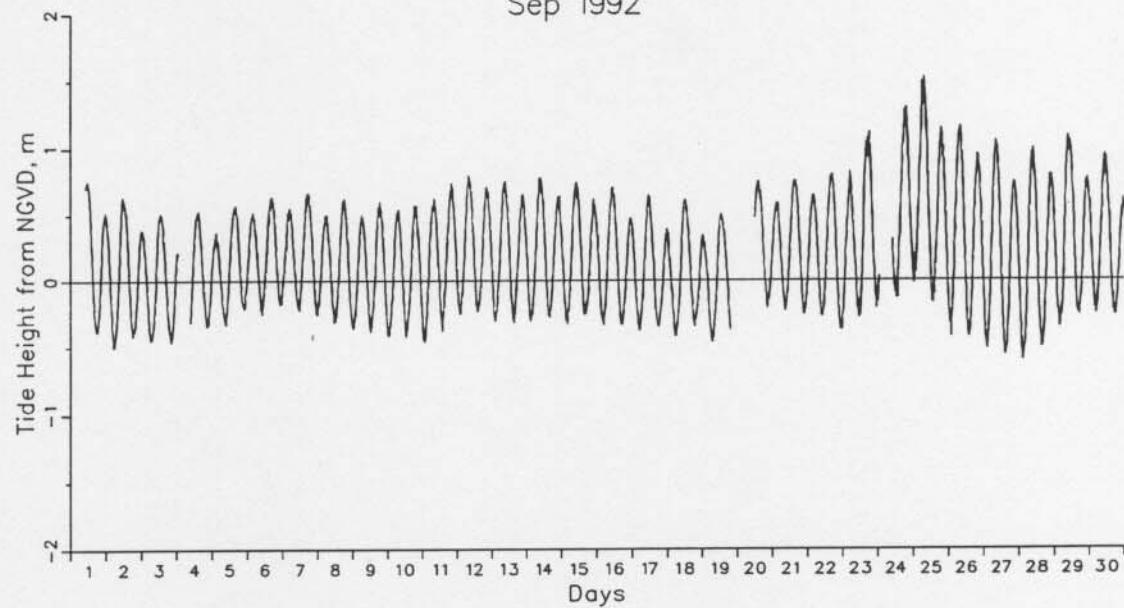


Figure 4. Water level time history

Monthly Water Levels,m NGVD

Extreme Low = -0.60 on day 28 at 142 EST
Extreme High = 1.53 on day 25 at 612 EST
Monthly Mean = 0.20
Mean Low = -0.32
Mean High = 0.75
Mean Range = 1.07

Table 6: Water Levels, m NGVD

		Sep 1992			
Day	Mid-Cycle Time	Low	High	Mean	Range
1	1418	-0.38	0.76	0.15	1.14
2	243	-0.50	0.57	0.03	1.07
2	1508	-0.42	0.64	0.08	1.06
3	333	-0.45	0.42	-0.02	0.87
3	1558	-0.46	0.51	0.01	0.97
4		Gage Inoperative			
4	1649	-0.34	0.53	0.08	0.87
5	514	-0.33	0.37	0.04	0.71
5	1739	-0.21	0.57	0.18	0.78
6	604	-0.25	0.52	0.16	0.77
6	1830	-0.18	0.64	0.22	0.82
7	655	-0.23	0.55	0.18	0.78
7	1920	-0.26	0.67	0.20	0.93
8	745	-0.32	0.50	0.11	0.82
8	2010	-0.37	0.62	0.11	0.99
9	836	-0.39	0.50	0.08	0.89
9	2101	-0.42	0.60	0.08	1.02
10	926	-0.42	0.54	0.08	0.96
10	2151	-0.46	0.57	0.08	1.03
11	1016	-0.38	0.62	0.19	1.00
11	2242	-0.25	0.74	0.25	0.99
12	1107	-0.24	0.80	0.26	1.04
12	2332	-0.30	0.71	0.22	1.02
13	1157	-0.31	0.76	0.22	1.07
14	22	-0.30	0.77	0.21	1.08
14	1248	-0.28	0.79	0.24	1.06
15	113	-0.33	0.74	0.19	1.06
15	1338	-0.26	0.75	0.21	1.01
16	203	-0.34	0.70	0.16	1.04
16	1428	-0.34	0.71	0.13	1.05
17	253	-0.38	0.65	0.09	1.02
17	1519	-0.35	0.64	0.06	0.99
18	344	-0.42	0.61	0.03	1.04
18	1609	-0.35	0.59	0.07	0.94
19	434	-0.46	0.51	-0.02	0.97
19		Gage Inoperative			
20					
20	1750	-0.21	0.75	0.25	0.96
21	615	-0.23	0.75	0.23	0.98
21	1840	-0.26	0.76	0.24	1.02
22	705	-0.27	0.75	0.23	1.02
22	1931	-0.37	0.80	0.19	1.18
23	756	-0.28	1.05	0.32	1.33
23		Gage Inoperative			
24					
24	2111	-0.02	1.33	0.66	1.36
25	937	-0.17	1.53	0.62	1.70
25	2202	-0.43	1.15	0.39	1.57
26	1027	-0.43	1.16	0.35	1.58
26	2252	-0.52	0.95	0.23	1.47
27	1117	-0.56	1.05	0.22	1.62
27	2343	-0.60	0.82	0.13	1.42
28	1208	-0.51	1.00	0.22	1.51
29	33	-0.35	1.06	0.28	1.41
29	1258	-0.26	1.09	0.37	1.35
30	123	-0.26	0.82	0.30	1.08
30	1349	-0.27	0.95	0.28	1.22

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Geodimeter surveying system; a Geodimeter 140-T self-tracking, electronic theodolite, distance meter, in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the latest survey in August 1992 and the surveys in September 1992 on profile line 188, located 517 m south of the pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1992. Cross-hatched areas indicate changes to the annual envelope which occurred in September.

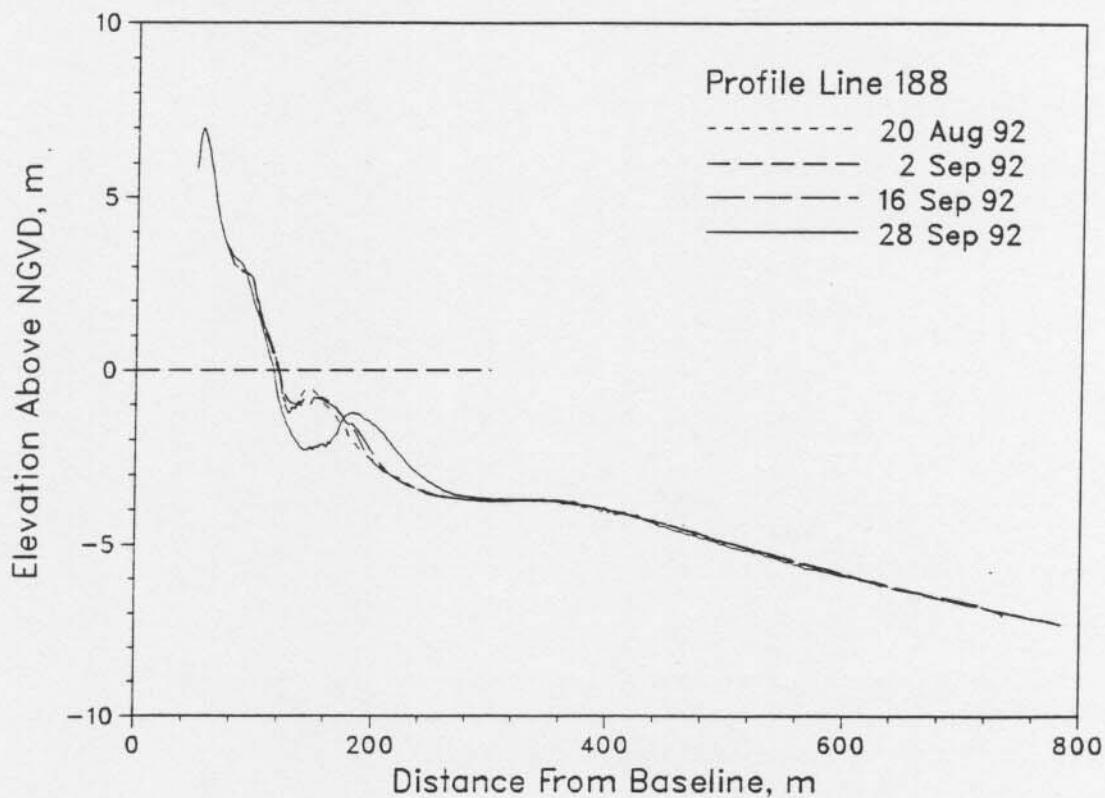


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

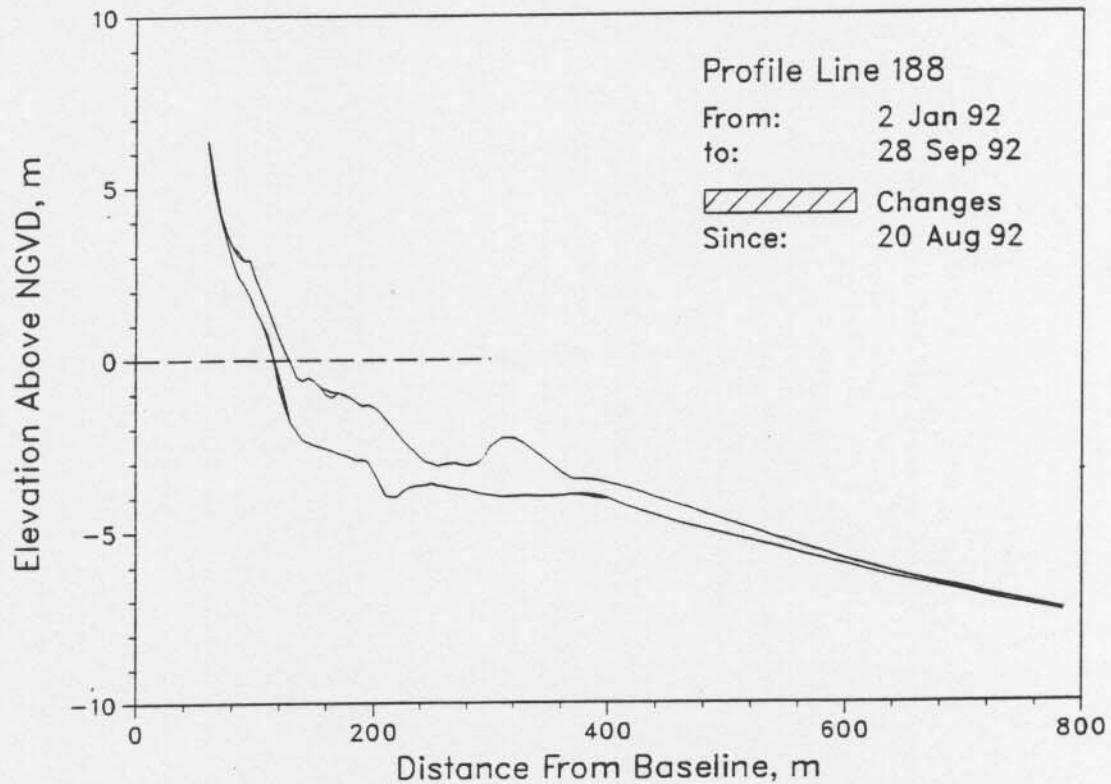


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 2 September. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

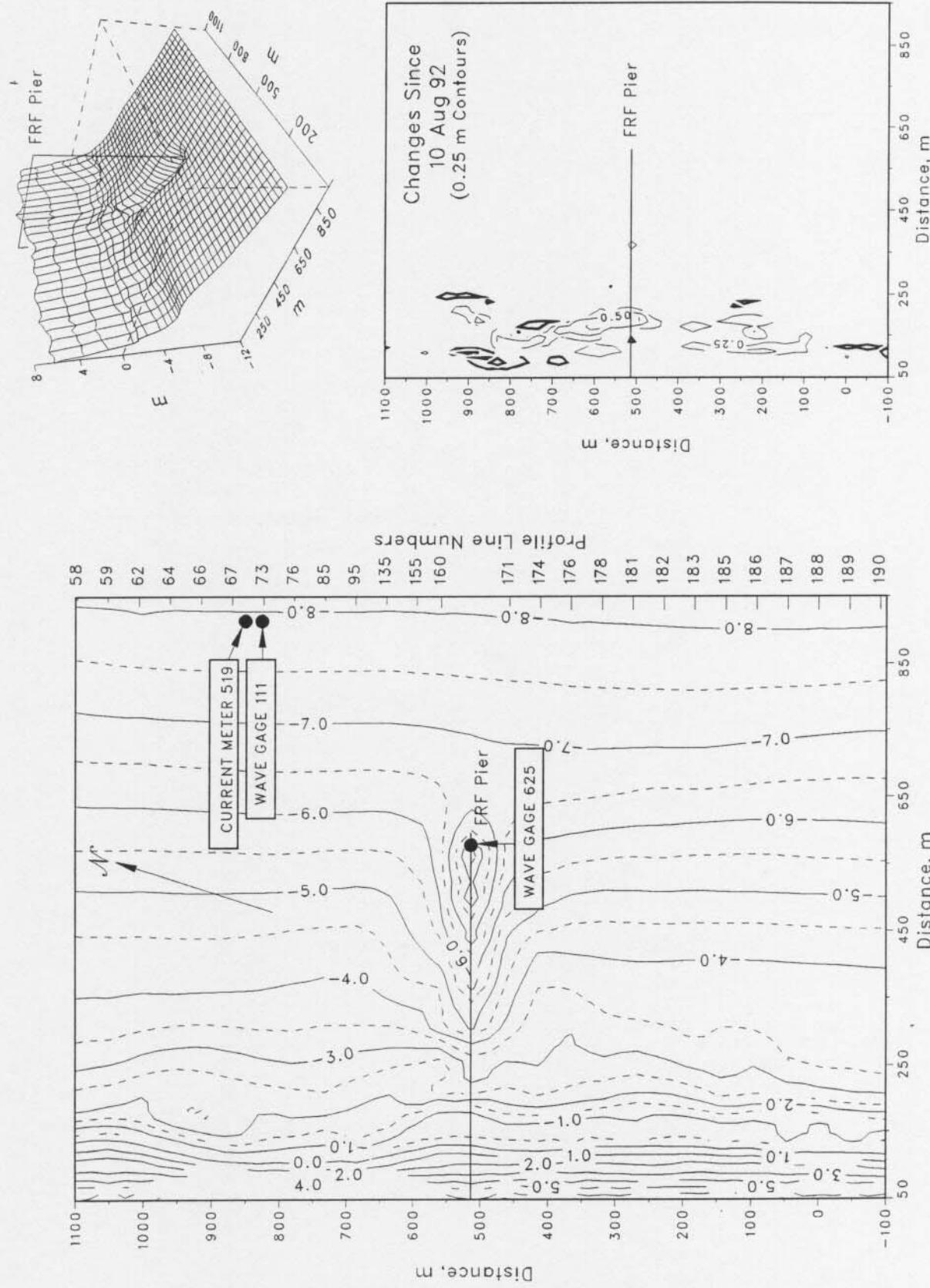


Figure 7. FRF bathymetry 2 Sep 92 depths relative to NGVD

PART VIII. SPECIAL EVENTS

- A. Storm Data Collection. The following list identifies times when the wave height H_{mo} at the seaward end of the pier (i.e. as measured near the end of the pier) exceeded 2 m.

<u>Start</u>	<u>End</u>
23 Sep (0808)	25 Sep (1516)

B. Storm Synopsis.

23 September Tropical Storm Danielle)

A tropical depression had developed off the North Carolina - South Carolina coast by the morning of 22 September. It tracked to the north, parallel to shore and by the morning of 23 September had intensified into a tropical storm located about 100 miles southeast of Cape Hatteras. Interaction with a cold front off the coast of North Carolina caused Danielle to head ashore. The eye of the storm came ashore at the northern beaches of North Carolina on the morning of 25 September, as it continued to move north along the Atlantic shore. The maximum H_{mo} (at gage 630) of 4.6 meters ($T_p = 9.5$ sec) was measured at 0734 EST on 25 September. Maximum winds (from northeast) reached 20.5 m/s on 25 September at 0542 EST. Winds were sustained above 15 m/s from 23 September through the early morning of 25 September. The minimum atmospheric pressure of 1010.8 mb was measured at 0842 also on 25 September. There was 15 mm total precipitation.

Distribution List

Government Agencies:

OCE	U.S. Geological Survey
BERH	U.S. National Park Service
NAO	U.S. Naval Academy
NASA/Wallops Flight Center	U.S. Naval Civil Eng. Lab
NOAA (NOS, NWS)	U.S. Naval Fac. Eng. Com.
SAD	U.S. Naval Oceanographic Off.
SAW	U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.	Stockton State College
East Carolina University	University of Akron
Florida Inst. of Tech.	University of Delaware
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Old Dominion University	University of North Carolina
Oregon State University	University of N. Colorado
Prince George's College	University of Rhode Island
Rutgers University	University of Virginia
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Southern Illinois University	

Others:

City of Va. Beach, VA	MEC Systems Corporation
Coastal Barge Corporation	Moffatt & Nichol, Eng.
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W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
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Ministry of Construction, Coastal Division (Japan)
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University of New South Wales (Australia)
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